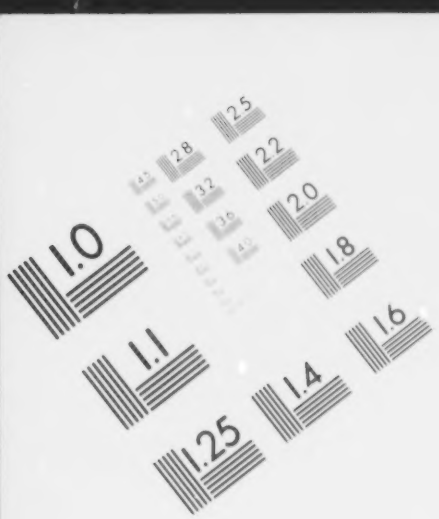

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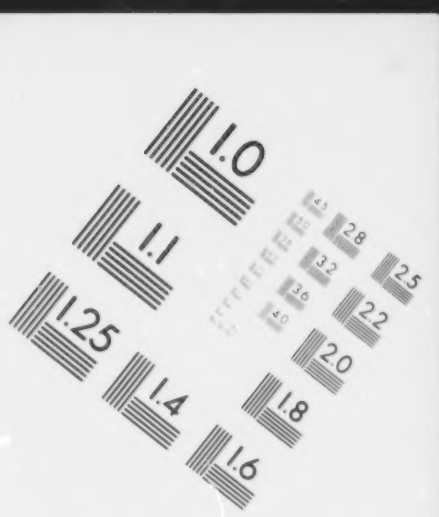

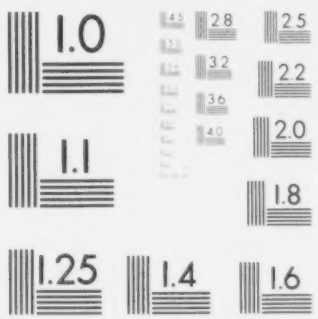

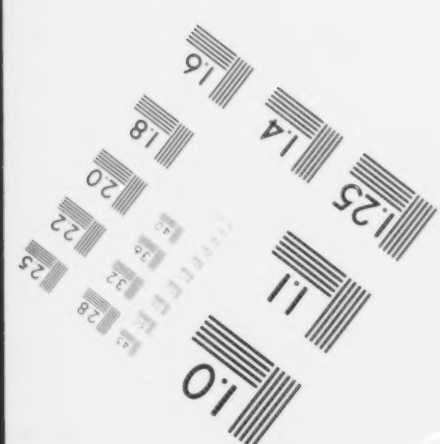

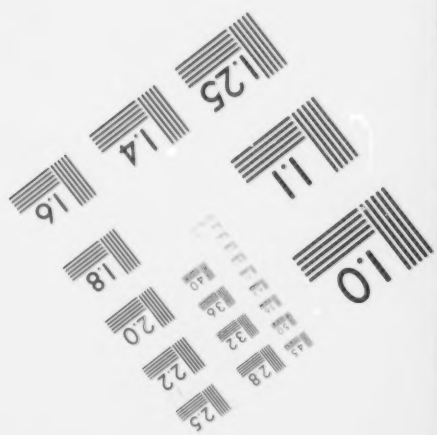

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ABSTRACT

A general methodology approach is suggested for measurement of workforce readiness competencies in the context of overall work by the National Center for Research on Evaluation, Standards, and Student Testing on the domain-independent measurement of workforce readiness skills. The methodology consists of 14 steps, from the initial selection of a work environment to the preparation of a report documenting the process. After selection of the work environment, a job and task analysis is conducted, and a competency or skill is selected that is present in the work environment. Component analysis divides the competency into constituent subcompetencies for which indicators are created. Indicators are classified within a cognitive science taxonomy; and measures of the competency are selected or developed, followed by empirical studies, statistical analysis, norm creation, and production of a report on the indicators. A report on the assessment using multiple indicators finally results. Application of the general method to a specific case for the Secretary of Labor's Commission on Achieving Necessary Skills (SCANS) is documented. Two measures of workforce readiness competencies are proposed for the SCANS example of a new restaurant. Further development of these measures and empirical validation will be conducted in Year 2 of the effort. Twelve tables summarize the methodology. An appendix provides the restaurant scenario for the assessments. (SLD)

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Measurement of Workforce Readiness Competencies: Design of Prototype Measures

CSE Technical Report 344

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MEASUREMENT OF WORKFORCE READINESS COMPETENCIES: DESIGN OF PROTOTYPE MEASURES

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Introduction

The Cognitive Science Laboratory of USC has a subcontract with the Center for Research on Evaluation, Standards, and Student Testing (CRESST) at the University of California, Los Angeles to assist in the domain-independent measurement of workforce readiness skills. In turn, CRESST/ UCLA has an existing grant from the Office of Educational Research and Improvement to study methodologies for the assessment of competencies needed for the workforce. CRESST/UCLA areas of interest include both assessment and policy issues. The purpose of this report (Deliverable 3 on our USC subcontract) is to provide a context for our work, that is, the Secretary's Commission on Achieving Necessary Skills (SCANS), as well as to suggest a general methodology approach for measurement of workforce readiness competencies that has been instantiated in two measures.

Workforce Readiness Assessment Methodology

The methodology that we will document in this report consists of 14 steps, from the initial selection of a work environment to the report documenting the process (see Table 1). As seen in Table 1, following selection of a work environment, a job and task analysis is conducted to determine the requirements for the job. Then a competency or skill is selected that is assumed or documented to be present in the work environment. Possible competencies would be academic (e.g., reading) or interpersonal skills (e.g., participating as a member of a team), etc. Unfortunately, such molar categories do not map directly onto an assessment measure, and some further

Table 1

Workforce Readiness Assessment Methodology

• Select a work environment
• Job and task analysis
• Select competency
• Conduct component analysis of competency
• Create indicator(s) for subcompetencies
• Classify indicator(s) within a cognitive science taxonomy
• Create rapid prototypes of measures of indicator(s) test via specifications
• Select/develop final measures of indicator(s)
• Select experimental/analytical design
• Run empirical studies
• Analyze statistically
• Use/create norms
• Report reliability/validity of indicator(s) measure
• Report on workforce readiness competency using multiple indicators

level of decomposition is required. Thus, the cognitive analysis step is implemented and a component analysis is conducted in order to analyze the competency into its constituent subcompetencies. Next, indicators are created for the subcompetencies.

The indicators are then classified within a cognitive science taxonomy. The purpose of this step is to allow generalization of the findings from an indicator to a high-order subcompetency. Then, measures of the competency are selected or developed in two steps: (a) rapid prototypes are developed and tested, and (b) prototypes are refined into final measures. Both process and outcomes are measured. Next, an experimental/analytical design is selected and empirical studies run. The data are statistically analyzed with a focus on psychometric issues (e.g., internal consistency, construct validity), and norms are used or created. A report on the reliability and validity of the indicator is written. Finally, a report on the assessment of the workforce competency using multiple indicators is written.

The application of this general method to a specific case for SCANS will be documented in this report and follows in the next section. This report uses several analytical approaches as "proof of concept" of our methodology but does not provide an empirical study. Empirical validation will be conducted in Year 2 of this effort.

SCANS

SCANS is a commission charged by the U.S. Secretary of Labor to investigate what is required in today's and tomorrow's workplace and to determine the extent to which high school students are able to meet those requirements. SCANS was chosen as a target system for our methodology for two reasons. First, the SCANS approach includes almost all the competencies we are interested in for our assessment approach (for example, SCANS was meant to be a national rather than a state or regional assessment). Second, we have a good, cooperative relationship with the SCANS staff.

Specifically, SCANS was directed by the Secretary of Labor to (a) define the skills needed for employment, (b) propose acceptable levels of proficiency, (c) suggest effective ways to assess proficiency, and (d) develop a dissemination strategy for the nation's schools, businesses, and homes. In June 1991, the Commission issued a report concerning the first two directives (SCANS, 1991). The Commission, based on its discussions and meetings with business owners, public employers, unions, and workers and supervisors in shops, plants, and stores, identified five competencies in accordance with the first directive: the ability to efficiently use (a) resources, (b) interpersonal skills, (c) information, (d) systems, and (e) technology (see Table 2). Additionally, the Commission found that these five competencies are based on a three-part foundation: (a) basic skills, (b) thinking skills, and (c) personal qualities (see Table 3).

Table 2. SCANS: Five Competencies

Resources: Identifies, organizes, plans, and allocates resources

A. *Time*—Selects goal-relevant activities, ranks them, allocates time, and prepares and follows schedules

B. *Money*—Uses or prepares budgets, makes forecasts, keeps records, and makes adjustments to meet objectives

C. *Material and Facilities*—Acquires, stores, allocates, and uses materials or space efficiently

D. *Human Resources*—Assesses skills and distributes work accordingly, evaluates performance and provides feedback

Interpersonal: Works with others

A. *Participates as Member of a Team*—Contributes to group effort

B. *Teaches Others New Skills*

C. *Serves Clients/Customers*—Works to satisfy customers' expectations

D. *Exercises Leadership*—Communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies

E. *Negotiates*—Works toward agreements involving exchange of resources, resolves divergent interests

F. *Works with Diversity*—Works well with men and women from diverse backgrounds

Information: Acquires and uses information

A. *Acquires and Evaluates Information*

B. *Organizes and Maintains Information*

C. *Interprets and Communicates Information*

D. *Uses Computers to Process Information*

Systems: Understands complex inter-relationships

A. *Understands Systems*—Knows how social, organizational, and technological systems work and operates effectively in them

B. *Monitors and Corrects Performance*—Distinguishes trends, predicts impacts on system operations, diagnoses deviations in systems' performance and corrects malfunctions

C. *Improves or Designs Systems*—Suggests modifications to existing systems and develops new or alternative systems to improve performance

Technology: Works with a variety of technologies

A. *Selects Technology*—Chooses procedures, tools or equipment, including computers and related technologies

B. *Applies Technology to Task*—Understands overall intent and proper procedures for setup and operation of equipment

C. *Maintains and Troubleshoots Equipment*—Prevents, identifies, or solves problems with equipment, including computers and other technologies

(SCANS, 1991, p. 12)

Table 3

SCANS: A Three-Part Foundation

Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks

A. *Reading*—Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules

B. *Writing*—Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts

C. *Arithmetic/Mathematics*—Performs basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques

D. *Listening*—Receives, attends to, interprets, and responds to verbal messages and other cues

E. *Speaking*—Organizes ideas and communicates orally

Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn, and reasons

A. *Creative Thinking*—Generates new ideas

B. *Decision Making*—Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative

C. *Problem Solving*—Recognizes problems and devises and implements plan of action

D. *Seeing Things in the Mind's Eye*—Organizes and processes symbols, pictures, graphs, objects, and other information

E. *Knowing How to Learn*—Uses efficient learning techniques to acquire and apply new knowledge and skills

F. *Reasoning*—Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem

Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty

A. *Responsibility*—Exerts a high level of effort and perseveres towards goal attainment

B. *Self-Esteem*—Believes in own self-worth and maintains a positive view of self

C. *Sociability*—Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings

D. *Self-Management*—Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control

E. *Integrity/Honesty*—Chooses ethical courses of action

(SCANS, 1991, p. 16)

Although their work with regard to the second directive is not yet complete, the Commission also suggested a five-step progression in skills acquisition to define proficiency levels for each of the competencies identified. The five steps in level of skill acquisition are (a) preparatory, (b) work-ready, (c) intermediate, (d) advanced, and (e) specialist. The second level of skills acquisition, *work-ready*, defines the level of proficiency necessary for entry into the workforce. Although the Commission has yet to specify the precise levels of skill acquisition which would be considered work-ready, it did provide examples of how those proficiency levels might look (SCANS, 1991) (see Table 4).

CRESST and its subcontractor, USC, have been asked to participate in the third directive, namely to suggest effective ways of assessing proficiency levels of the competencies identified by the Commission in its June 1991 report. Our report documents progress in the development of an assessment model or framework and its instantiation in the assessment of two of the five workforce competencies. Specifically, approaches to the assessment of the information and interpersonal competencies are suggested. It should be noted that while the assessment approaches focus on the two competencies specified, other workforce-readiness components identified by the Commission are also involved. As the Commission explained in its report, "seldom does one of these eight components stand alone in job performance. They are highly integrated and most tasks require workers to draw on several of them simultaneously" (SCANS, 1991, p. vi). Accordingly, our approach recommends the assessment of competencies in the context of the foundation skills as well.

Developing Rapid Prototypes

The specific approach to developing rapid prototypes for indicators of the two competencies of primary focus (information and interpersonal) will be described in the following manner. First, the specifications for the sources of suggested test content will be elaborated. According to Millman and Greene (1989), when tests are designed to assess future performance in a specified setting, an analysis of the cognitive requirements of that setting includes two steps:

Table 4

Know-How: Work-Ready Level of Proficiency

COMPETENCE	EXAMPLE OF LEVEL
RESOURCES	Develop cost estimates and write proposals to justify the expense of replacing kitchen equipment. Develop schedule for equipment delivery to avoid closing restaurant. Read construction blueprints and manufacturers' installation requirements to place and install equipment in the kitchen.*
INTERPERSONAL	Participate in team training and problem-solving session with multi-cultural staff of waiters and waitresses. Focus on upcoming Saturday night when local club has reserved restaurant after midnight for a party. Three people cannot work and team has to address the staffing problem and prepare for handling possible complaints about prices, food quality, or service.*
INFORMATION	Analyze statistical control charts to monitor error rate. Develop, with other team members, a way to bring performance in production line up to that of best practice in competing plants.**
SYSTEMS	As part of information analysis above, analyze painting system and suggest how improvements can be made to minimize system downtime and improve paint finish.**
TECHNOLOGY	Evaluate three new paint spray guns from the point of view of costs, health and safety, and speed. Vendors describe performance with charts and written specifications. Call vendors' representatives to clarify claims and seek the names of others using their equipment. Call and interview references before preparing a report on the spray guns and make a presentation to management.**

Progress in Acquiring Skills

PROFICIENCY LEVEL	PERFORMANCE BENCHMARK
PREPARATORY	Scheduling oneself
WORK-READY	Scheduling small work team
INTERMEDIATE	Scheduling a production line or substantial construction project
ADVANCED	Developing roll-out schedule for new product or production plant
SPECIALIST	Develop algorithm for scheduling airline

*Competence as demonstrated in a service sector application.
**Competence as demonstrated in a manufacturing sector application.

(Adapted from SCANS, 1991, pp. 26, 28)

> *First*, the specific cognitive requirements of the criterion setting are identified, through a job analysis for employment settings. . . . *Second*, the content specification of the predictive test is developed . . . [commonly using the] cognitive indicators known or hypothesized to be positively related to the criterion requirements. (p. 341)

The Commission, in its study of the workforce, completed the first step in Millman and Greene's (1989) process by identifying the cognitive requirements for the criterion setting, namely, specific competencies in the workforce. SCANS derived this information via expert judgment, not job analysis.

In completing the second assessment step, cognitive indicators known or hypothesized to be positively related to the criterion requirements are identified. The research literature is analyzed to identify these cognitive indicators.

Subsequent to the specification of sources of test-item content, sample test items are developed. Finally, specifications for the generation of further test items, such as our sample items, are elaborated. The form for the test item writing specifications is taken from Baker, Aschbacher, Niemi, Yamaguchi, & Ni (1991) and Millman and Greene (1989).

Because the Commission is currently working to define the work-ready proficiency level, it is not possible at this point to provide a precise account of how scores on these tests would translate into proficiency levels. Once the work-ready proficiency level is specified, pilot studies can be conducted to relate the test items to the work-ready proficiency level.

The Information Competency

Based upon its discussions and meetings with business owners, public employers, unions, and workers and supervisors in shops, plants, and stores, the Commission found that the ability to productively use information is critical to productivity in the workforce. Technological advances have both increased dramatically the amount of information generated and made this information potentially more accessible. This explosion in the amount of information, along with the rapidity of change in today's workplace, has contributed to a heightened need for the efficient use of information. Accordingly, the Commission elaborated the cognitive requirements for the information competency of the workforce as follows (SCANS, 1991, pp. B1-B2).

Acquires and Evaluates Information. Identifies need for data, obtains it from existing sources or creates it, and evaluates its relevance and accuracy.

Organizes and Maintains Information. Organizes, processes, and maintains written or computerized records and other forms of information in a systematic fashion.

Interprets and Communicates Information. Selects and analyzes information and communicates the results to others using oral, written, graphic, pictorial, or multi-media methods.

Uses Computers to Process Information. Employs computers to acquire, organize, analyze, and communicate information.

It is also clear that the information usage competency must be combined with the ability to solve problems—one of the important skills identified by the Commission as part of the thinking skills foundation. That is, information often must be productively used to solve problems based on that information.

Researchers have examined the cognitive indicators of the intelligent use of information in problem solving. In particular, we have drawn upon the work of Sternberg (1986) and Mayer, Tajika, and Stanley (1991), who have not only examined the cognitive indicators of the intelligent use of information in problem solving theoretically and empirically but also developed tests of the indicators they have identified.

Mayer et al. (1991) identified the *integration process* as one cognitive indicator of competence in the intelligent use of information to solve problems. The integration process is the ability to identify relevant information, distinguishing it from irrelevant information, and then integrate the relevant information to solve problems. Table 5 provides a suggested test item for this competency.

Table 5

Test Item for Integration Process

Lucia had $3.00 for lunch. She bought a sandwich for $.95, an apple for $.20, and a milk for $.45. How much money did she spend?				
a.	3.00,	.95,	.20,	.45
b.	.95,	.20,	.45	
c.	.95,	.45		
d.	3			
(Answer: b)				

(Adapted from Mayer, Tajika, & Stanley, 1991)

Sternberg (1986) has identified three cognitive processes, similar to Mayer et al.'s (1991) integration process, that indicate competence in the intelligent use of information in problem solving. First, one must *selectively encode* the information available to solve the problem. In other words, one must identify, from the host of information available, which information is relevant to the problem at hand and attend to it. Second, one must *selectively combine* the relevant pieces of information. Sternberg observes that although there are usually several ways of combining information, there is usually a single optimal way for generating a solution to a particular problem. Third, one must *selectively compare* the new information with relevant, previously-acquired information in solving problems intelligently. Table 6 provides a sample test item for the selective combination aspect of the information and thinking skills cognitive indicators suggested by Sternberg (1986).

Table 6

Test Item for Selective Combination

David is a cook in a small restaurant named "Lester's" which specializes in steaks. The restaurant has recently become so popular that the average wait to be seated is one hour. Mr. Lester has therefore asked David to reduce the amount of time needed to cook an order of six steaks to under one hour. The restaurant has a small grill just big enough to broil four steaks at a time. David says to himself, "It takes 30 minutes to broil both sides of one steak because each side takes 15 minutes. Since I can cook four steaks at the same time, 30 minutes will be enough to get four steaks ready. It will take another 30 minutes to cook the remaining two steaks which means a total of one hour." How can David complete cooking all six steaks in just 45 minutes?

Answer:

If one combines the information that there are six steaks that take 15 minutes per side to broil, in other words, 12 sides to be broiled for 15 minutes, with the information that four steaks can be broiled at the same time, one can see that if four steaks are always on the grill, it will take only 45 minutes to grill all six. Assuming the six steaks are grouped into three pairs labeled A, B, and C, David can accomplish keeping four steaks on the grill by first broiling one side of the two A and two B steaks, taking off the B steaks and broiling side 2 of the A steaks and side 1 of the C steaks, and then broiling side 2 of the B and C steaks.

(Adapted from Sternberg, 1986)

In summary, as seen in Table 7, we have used Mayer et al. and Sternberg's approaches to assessing the information competency, focusing primarily (P) on the "interpreting and communicating data" aspect of the information competency combined with both the problem solving skills identified as part of the thinking skills foundation competency and the arithmetic and mathematics skills identified as part of the basic skills foundation competency. A secondary (S) focus in this assessment approach, as also seen in Table 7, is the "acquiring and evaluating information" aspect of the information competency as well as the creative-thinking and decision-making skills identified as parts of the thinking skills foundation.

Table 7

Information Competency

	Acquiring & Evaluating Information	Organizing & Maintaining Information	Interpreting & Communicating Information	Using Computers
Thinking Creatively	S		S	
Making Decisions	S		S	
Solving Problems	S		**P**	
Seeing Things in Mind's Eye				
Knowing How to Learn				
Reasoning				
Reading				
Writing				
Arithmetic	S		**P**	
Mathematics	S		**P**	
Listening				
Speaking				

Note. S = secondary focus, **P** = primary focus.

In the next section are item-writing specifications, adapted from Millman and Greene (1989, p. 352), for generating sample items such as those above.

Item-Writing Specifications

SCANS Competencies to be Tested

Competencies of primary focus.

1. The information competency: The interpreting and communicating information subcompetency, which is the ability to select and analyze information and to communicate the results to others using oral, written, graphic, pictorial, or multi-media methods (SCANS, 1991, p. B1).

2. The basic skills foundation:

   Arithmetic: Performs basic computations; uses basic numerical concepts, such as whole numbers and percentages, in practical situations; makes reasonable estimates of arithmetic results without a calculator; and uses tables, graphs, diagrams, and charts to obtain or convey quantitative information (SCANS, 1991, p. C1).

   Mathematics: Approaches practical problems by choosing appropriately from a variety of mathematical techniques; uses quantitative data to construct logical explanations for real world situations; expresses mathematical ideas and concepts orally and in writing; and understands the role of chance in the occurrence and prediction of events (SCANS, 1991, p. C1).

3. The thinking-skills foundation: The problem-solving subskill, which is the ability to recognize that a problem exists (i.e., there is a discrepancy between what is and what should or could be), to identify possible reasons for the discrepancy, and to devise and implement a plan of action to resolve it. It also includes the ability to evaluate and monitor progress, and to revise the plan as indicated by findings (SCANS, 1991, p. C1-C2).

Competencies of secondary focus:

1. The information competency: The acquire-and-evaluate-information subcompetency is the ability to identify the need for information, to

obtain it from existing sources or to create it, and to evaluate its relevance and accuracy (SCANS, 1991, p. B1).

2. The thinking skills foundation:

   Creative thinking: Uses imagination freely, combines ideas or information in new ways, makes connections between seemingly unrelated ideas, and reshapes goals in ways that reveal new possibilities (SCANS, 1991, p. C1).

   Decision making: Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternatives (SCANS, 1991, p. C1).

Rationale

Increased volume of information at work and an increased need for workers at all levels to be able to use this information effectively require that all workers be efficient information managers.

Content Specification

Cognitive indicators, either known or hypothesized, of the ability to perform the cognitive requirements identified by the Commission should be found in relevant research as a source for test content (Millman & Greene, 1989). In this instance, test content was drawn from the work of Sternberg (1986) and Mayer et al. (1991). The specific cognitive indicator drawn from Mayer et al. was:

> **Integration**: The ability to select and combine information into a coherent representation of the entire problem.

The specific cognitive indicator drawn from Sternberg was:

> **Selective Combination**: The ability to combine information into a meaningful whole, in which associations between relevant pieces of information are understood, in order to solve a problem.

Context Attributes

The context should include a work-place setting involving a problem which requires the use of information to solve it. The relevant information can

be applied in several possible ways but in only one optimal way for the problem involved.

Question Attributes

Questions of the following two types can be asked:

1. Multiple-choice questions in which students must choose the multiple-choice option that accurately identifies all and only the information relevant to the given problem.

2. Questions in which the students must identify the relevant information and then combine it in the optimal way to generate a solution in written form to the given problem.

Response Attributes

Responses to the first type of question are simply identification of the one correct multiple-choice option. Responses to the second type of question must clearly describe in written form the optimal solution to the problem

Relationship of Scores to SCANS Proficiency Levels

As mentioned, the Commission is currently working towards greater specification of proficiency levels. It is therefore not possible, at this time, to specify what levels of performance on these test items would constitute "work-ready" levels of proficiency. Once the Commission has completed its work, studies can be conducted to relate scores to proficiency levels.

Summary of Instantiation of Assessment Methodology

In the prior section we have instantiated our general methodology (see Table 1) in the context of the specific SCANS competency "information." This instantiation is summarized in Table 8. An additional step, "Specify basic skills foundation," is added in the SCANS case.

Table 8

Workforce Readiness Assessment Methodology for SCANS: Example 1

General Methodology	Specific Example
• Select a work environment	Analytically derived
• Job and task analysis	Analytically derived
• Select competency	Information management (SCANS)
• Conduct component analysis of competency	Interpreting and Communicating Information
• Specify basic skills foundation	Arithmetic, Mathematics, Thinking Skills
• Create indicator(s) for subcompetencies	Integrating process; Selective combination
• Classify indicator(s) within a cognitive science taxonomy	Mayer et al., 1991; Sternberg, 1986
• Create rapid prototype of measures of indicator(s) via test specifications	[see Table 5, Table 6]
• Select/develop final measures of indicator(s)	To be done
• Select experimental/analytical design	Criterion groups
• Run empirical studies	To be done
• Analyze statistically	To be done
• Use/create norms	To be done
• Report reliability/validity of indicator(s) measure	To be done
• Report on workforce readiness using multiple indicators	To be done

The Interpersonal Competency

One of the five competencies the Commission identified as critical to productive performance in the workforce is interpersonal skills. Specifically, interpersonal skills were identified to consist of the ability to participate as a member of a team, to teach others, to serve clients and customers, to exercise leadership, to negotiate, and to work with cultural diversity (SCANS, 1991, p. B1). The identification of the interpersonal competency as critical results in part from the Commission's finding that a trend exists toward organizing workers in terms of teams and toward decision making closer to the front line (SCANS, 1991, pp. 3-4).

The Commission's findings that, to be competitive, America needs to organize its workforce in terms of teams that take on problem-solving and decision-making responsibilities formerly left to managers further up the management hierarchy are confirmed by other commissions and task forces examining the skills demands of America's workforce (e.g., Employability Skills Task Force, 1989; National Center on Education and the Economy, 1990). However, as more tasks and responsibilities are shared and fulfilled cooperatively by several persons rather than by individuals acting alone, the potential for interpersonal friction increases.

The Commission went on to argue:

> Interpersonal competence is the lubricant of the workplace, minimizing friction and the daily wear and tear of work. It also undergirds restructured work organizations in factories and provides the "service" in service firms. It is required if teams are to solve problems that they jointly face. All of these competent workers function effectively in quite complicated interpersonal environments. A false step in most of these situations invites resistance from colleagues or clients ... (SCANS, 1991, p. 13)

In elaborating the cognitive requirements of the interpersonal competency, the Commission defined the following six subcompetencies (SCANS, 1991, p. B1):

Participates as a Member of a Team. Works cooperatively with others and contributes to group with ideas, suggestions, and effort.

Teaches Others. Helps others learn.

Serves Clients/Customers. Works and communicates with clients and customers to satisfy their expectations.

Exercises Leadership. Communicates thoughts, feelings, and ideas to justify a position; encourages, persuades, convinces, or otherwise motivates an individual or groups, including responsibly challenging existing procedures, policies, or authority.

Negotiates. Works towards an agreement that may involve exchanging specific resources or resolving divergent interests.

Works with Cultural Diversity. Works well with men and women and with a variety of ethnic, social, or educational backgrounds.

The *Michigan Employability Skills Employer Survey* also identified several skills related to the interpersonal skills identified by the Commission that are critical to the workforce (Mehrens, 1989). The Michigan task force administered surveys to a wide variety and large number of employers in the workforce to gain their perceptions of the skills required by all workers. Each employer was asked to rate 86 skills on a 4-point scale, where 1 = critical, 2 = highly needed, 3 = somewhat needed, and 4 = not needed. "Pay attention to the person speaking" received a mean rating of 1.4. "Ask questions to clarify understanding" received a mean rating of 1.5. "Cooperate with others" received a mean rating of 1.6. All three skills just mentioned were in the top 20 of the 86 skills identified on the survey.

Researchers have examined the cognitive indicators of a number of interpersonal competencies that the Commission found critical to productivity in the workforce. Specifically, the cognitive indicators of the "negotiates" subcompetency, which is defined (SCANS, 1991, p. B1) as the ability to work towards an agreement that may involve exchanging specific resources or resolving divergent interests, are examined in the research on integrative negotiation skills (e.g., Womack, 1990).

Integrative negotiation skills can be defined in terms of three subskills. The first subskill is the ability to understand and articulate the common goals and interdependency of various colleagues with whom one must work closely and cooperatively. Second, integrative negotiation skills include the ability to communicate the interests, values, knowledge, and priorities underlying one's own suggestions, opinions, and decisions at work, as well as the ability to understand and appreciate similar communications from other colleagues and team members. Third, integrative negotiation skills include the ability to work with others in integrating (thus, the name) the valuable information

gained through this effective communication to generate creative solutions to problems and tasks encountered at work.

The three integrative negotiation subskills can also clearly be seen as cognitive indicators of the "participates as a member of a team" and "exercises leadership" interpersonal subcompetencies, as defined by the Commission. The "participates as a member of a team" subcompetency is defined as the ability to work cooperatively with others and to contribute to a group with ideas, suggestions, and effort (SCANS, 1991, p. B1). Certainly proficiency in integrative negotiation skills indicates the ability to cooperatively share ideas and suggestions in group efforts.

The "exercises leadership" subcompetency is defined as the ability to communicate thoughts, feelings, and ideas to justify a position, and to encourage, persuade, convince, or otherwise motivate an individual or group, including responsibly challenging existing procedures, policies, or authority (SCANS, 1991, p. B1). The ability to communicate thoughts, feelings, and ideas to justify a position is explicitly demonstrated by proficiency in integrative negotiation. One of the major advantages of an integrative approach discussed in the literature is to facilitate the responsible challenge of existing policies, procedures, or authority.

As seen in Table 9, our analysis of these interpersonal competencies indicates that they also typically draw upon several thinking foundation skills. In particular, creative-thinking, decision-making, and problem-solving skills (SCANS, 1991, pp. C1-C2) are required for and are indicated by proficiency in integrative negotiation. In sum, research on integrative negotiation skills documents important cognitive indicators of the interpersonal and thinking skills competencies identified by the Commission as critical to performance in the workforce. An overview of important research establishing these cognitive indicators follows.

Table 9

Interpersonal Skills

	Working on Teams	Teaching Others	Serving Customers	Leading	Negotiating	Working with Cultural Diversity
Thinking Creatively	S			S	**P**	
Making Decisions	S			S	**P**	
Solving Problems	S			S	**P**	
Seeing Things in Mind's Eye						
Knowing How to Learn						
Reasoning						

Note. S = secondary focus, **P** = primary focus.

One of the most thorough treatments of research on integrative negotiation skills is offered in Womack's (1990) review of basic and applied research on negotiation of conflict resolution in organizations. Similar to other researchers (e.g., Brett, Goldberg, & Ury, 1990), Womack concludes from her review that an integrative approach is generally more effective in achieving solutions that satisfy the interests and concerns of the colleagues involved in problems and disputes, and, therefore, such an approach results in longer-lasting resolutions that better meet organization and individual needs. She also concludes that integrative negotiation skills contribute to enhanced relations between fellow workers.

Womack (1990) also offers an extensive treatment of research on the effectiveness of particular integrative negotiation skills. First, when fellow workers or team members are discussing problems over which there are divergent opinions, the parties concerned should verbally emphasize their

interdependence. Each party should also openly and clearly communicate information about its own interests and concerns as well as listen carefully to that information from the other party. The verbal communication should also include exploratory problem solving, expression of arguments in support of the other party's position, and a willingness to accept the other's analysis and proposals as legitimate and reasonable.

Brett et al. (1990) also emphasize the role of integrative communication skills in dealing with work situations involving divergent opinions. Based on their own as well as others' research, Brett et al. (1990) argue the importance of the open exchange of information about each party's interests relevant to the dispute rather than communication of principles upon which a party thinks a conflict should be resolved. Their argument is that abstract principles and rights imperfectly represent the parties' real interests and concerns, thereby making resolution of the dispute on such grounds virtually impossible.

Also, negotiations should include consideration of more than one interest at a time so that integrative trade-offs, corresponding to the parties' differential priorities, can be discovered. For example, although there may be issues where the parties to the dispute have clearly competitive interests, one issue might be of high priority to one party, while a different issue is of high priority to the other party. If both issues are considered together, each party can compromise on the issue of lesser priority and joint positive outcomes can be increased. Brett et al. (1990) also emphasize that the mutual dependence of the parties should be articulated so that a cooperative rather than a competitive orientation prevails whenever possible.

Brett et al. (1990) argue that when members of the workforce possess and use these integrative negotiation skills, solutions will be reached that better address the needs, concerns, and interests of the parties within the organization as well the needs the organization itself. Furthermore, the recurrence of disputes will be diminished. Thus, although an integrative, interest-based approach may result in more extended negotiations initially, those negotiations will lead to agreements which will hold and prevent later conflict.

Tjosvold (1990) has also addressed the issue of integrative communication in the workforce. Tjosvold asked members of a social service organization

about recent conflicts they had experienced at work. He found that when cooperative goals prevailed and integrative negotiation skills were used, communication was characterized by assistance and support for the interests and analyses of the other party, by a problem-solving orientation, by brainstorming for creative solutions for the interests of all parties, and by the integration of ideas from the various parties in achieving solutions to work problems. Ratings of the effectiveness of conflict resolution and the degree of trust in the other party were also high when an integrative orientation prevailed. Similar findings were reported by Pruitt and Syna (1983).

Pruitt and Syna (1983) also review several studies which indicate the effectiveness of role reversal, in which each party tries to argue the other side's position as accurately and effectively as it can. The results from such an approach tend to be superior understanding and greater sympathy for the other side's position, and a sense that one's own position had been understood and appreciated.

In summary, the research on integrative negotiation skills provides clear documentation of cognitive indicators of important aspects of the interpersonal competency identified by the Commission. This stream of research identifies the cognitive indicators of the negotiation subcompetency, which is the ability to negotiate an agreement involving exchanges of specific resources or resolving divergent interests. Integrative negotiation skills also serve as cognitive indicators of the "participates as a member of a team" and "exercises leadership" interpersonal subcompetencies as well as the creative, decision-making, and problem-solving thinking skills. According to the integrative negotiation skills research, three cognitive indicators of these competencies are (a) the ability to identify and articulate the common goals and interdependency of the parties, (b) the ability to effectively communicate the basis for one's own position as well as to understand and appreciate the other party's position(s), and (c) the ability to use the information gained to generate creative solutions.

Drawing upon a workforce scenario (see Table 10) described in the SCANS report (SCANS, 1991, pp. 9-10), sample test items for integrative negotiation skills were developed (see Table 11). The SCANS report describes three friends' endeavor to open their own restaurant to portray the Commission-

Table 10

Workforce Scenario

Greg, Anthony, and Kathleen have just embarked upon their entrepreneurial dream—opening their own restaurant (The Three Chefs) in a growing southern town. Each of them independently worked hard to get to this point, spending 10 or more years learning the ropes in the restaurant business, pooling their savings, and borrowing from friends and family to get the start-up capital they needed.

Greg has worked in the restaurant business the longest and has been wanting to start his own restaurant for several years so he could be his own boss and enjoy the benefits of his own labor. Greg has managed several restaurants and enjoys using his business skills to make restaurants a successful business endeavor. Greg put up 10% more start-up cash than Anthony and Kathleen and also took out a second mortgage on his home to satisfy the local bank's demand for security for operating credit. He serves as manager and "front-of-the-house" shift supervisor during the day.

Anthony loves to combine his creative talent with the skills he gained at a culinary arts school he attended in the Northeast to produce unique and delicious gourmet delights. Anthony trains the staff, does the bookkeeping, and prepares the evening meals, which he loves the most.

Kathleen has always enjoyed the restaurant business for the service it provides of offering a pleasant environment in which family and friends can enjoy a meal together. Kathleen majored in interior design in college and enjoys using the skills she gained to improve the ambiance of a restaurant. Even when not working, Kathleen enjoys going out with friends and family to a restaurant. She is the lunchtime chef and evening manager.

(Adapted from SCANS, 1991, pp. 9-10)

identified competencies in the accommodations and food services sector of the economy. Our modified version (Table 10) expands on each person's background and responsibilities and indicates how those differences in background and responsibilities led to divergent interests with regard to suggestions for improving the restaurant (see Appendix 1 for the original scenario). In three different questions, students are asked to perform one of the three cognitive indicators. Subsequent to the sample items below, the item-writing specifications which were used to generate the items are elaborated.

Table 11

Sample Test Items

Item 1: Articulate Common Goals

Write a short essay explaining the goal(s) which Greg, Anthony, and Kathleen have in common. Also explain the ways in which they need each other to accomplish their goals.

Item 2: Understand Others' Positions

The Three Chefs has been in business for one month. It has been moderately busy in that time. During the month, each partner has formed ideas and opinions about how to improve The Three Chefs. They have come together on Monday morning to discuss their various ideas. They have agreed that they will meet weekly at this time for 45 minutes to discuss the business. They have also agreed that they will take turns chairing the meeting, and it was decided that Greg would chair the first meeting.

Greg calls first on Anthony, who is hardly able to restrain his enthusiasm to express his suggestions. Anthony begins by telling Kathleen and Greg about a new commercial food processor he learned of through one of his old classmates at the culinary arts school. As Anthony explains different features of the processor, he comments on all the wonderful dishes he could prepare with it. He believes that the expense of the equipment, which is considerable, will be offset by the volume of business they will do by offering such wonderful food and by being able to charge more for it. He therefore suggests that they purchase the food processor. His discussion of possible new dishes they could offer leads him to a discussion of his other suggestion to order a wider variety of higher quality ingredients in order to serve the truly exquisite food he thinks they should offer.

After listening to Anthony's suggestions, Greg asks Kathleen to share her suggestions. Kathleen says she has received a few comments from their evening customers that The Three Chefs' decor is somewhat barren. Not wanting to expend too much capital without having a sense of how good their business was going to be, the three had decided to initially buy only the essentials for the restaurant's decor. Kathleen suggests that, since they have had an encouraging first month, they should invest in decorating The Three Chefs and offers her ideas of some of the improvements that could be made. Otherwise, she argues, people won't enjoy eating out at The Three Chefs and won't come back.

Pretend that you are Greg. Anthony and Kathleen have expressed their suggestions as described above. It is now your turn, but the 45 minutes allocated for the meeting have been taken up. Knowing that everyone has important preparations to make for the coming day, you suggest that you will write a summary of Anthony's and Kathleen's suggestions as well as your own suggestions rather than explaining them now. It is agreed that you will give this summary to Anthony and Kathleen to read before next Monday when the three of you will continue the discussion. As Greg, write such a summary. You should identify Anthony's and Kathleen's suggestions along with the reasons they offered to support those suggestions. You should try to represent Kathleen's and Anthony's positions as fairly as possible, while also representing Greg's position, as if you were Greg. In representing Greg's position, you should keep the following concerns in mind.

Table 11 (continued)

First, given that you put up 10% more start-up capital than the others and took out a second mortgage on your home to secure operating credit with the bank, you are quite concerned that costs at The Three Chefs be held to a minimum and profits maximized. Anthony's and Kathleen's suggestions, all of which sound as though they will involve considerable cash outlays, therefore concern you. Second, you have a couple of your own suggestions which correspond to your concerns. You have noticed that many of the lunchtime customers are in a hurry. On several occasions you heard customers commenting that they wished the food would be served more promptly so they wouldn't go over their lunch break. You also observed that between 12:00 and 1:00 it was often quite busy and that customers had sometimes waited for 20 minutes to be seated. Your idea, therefore, is to offer a menu with items that are quicker to prepare to better serve the customers. Furthermore, such a change would allow The Three Chefs to do a higher volume of business and therefore increase profits.

Write a short essay that summarizes everyone's position.

Item 3: Generation of Creative Solutions

With the information given in item 2, devise a compromise which takes into account Greg's, Anthony's, and Kathleen's mutual and individual concerns and suggestions. Your goal should be to devise a compromise that best incorporates the information provided by the three parties and that best and most fairly accommodates each of their positions. Write an essay describing that compromise and how it takes into account the concerns and issues raised.

Item-Writing Specifications

SCANS Competencies to be Tested (see Table 9)

Competencies of primary focus:

1. The "negotiates" subcompetency of the interpersonal competency: Works towards an agreement that may involve exchanging specific resources or resolving divergent interests (SCANS, 1991, p. B1).

Competencies of secondary focus:

1. The "exercises leadership" subcompetency of the interpersonal competency: Communicates thoughts, feelings, and ideas to justify position; encourages, persuades, convinces or otherwise motivates an individual or group(s), including responsibly challenging existing procedures, policies, or authority (SCANS, 1991, p. B1).

2. The "participates as a member of a team" subcompetency of the interpersonal competency: Works cooperatively with others and contributes to group with ideas, suggestions and effort.

3. The creative-thinking subskill of the thinking skills foundation: Uses imagination freely, combines ideas or information in new ways, makes connections between seemingly unrelated ideas, and reshapes goals in ways that reveal new possibilities.

4. The decision-making subskill of the thinking skills foundation: Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternatives.

5. The problem-solving subskill of the thinking skills foundation: Recognizes that a problem exists (i.e., there is a discrepancy between what is and what should or could be), identifies possible reasons for the discrepancy, and devises and implements a plan of action to resolve it. Evaluates and monitors progress, and revises plan as indicated by findings.

Rationale

Developments in the ways people are organized at work require more interpersonal skills to integrate the input of other members of a team in making decisions, thinking creatively, and solving problems to increase effectiveness.

Content Specification

Cognitive indicators, either known or hypothesized, of the ability to perform the cognitive requirements identified by the Commission should be found in relevant research as a source for test content (Millman & Greene, 1989). In this instance, test content was derived from the research on integrative negotiation skills. The cognitive indicators from the integrative research are summarized as:

1. The ability to understand and articulate the common goals and interdependency of various colleagues with whom one must work closely and cooperatively at work.

2. The ability to communicate the interests, values, knowledge, and priorities underlying one's own suggestions, opinions, and decisions at work, as well as the ability to understand and appreciate similar communications from other colleagues and team members.

3. The ability to work with others in integrating the valuable information gained through this effective communication to generate creative solutions to problems and tasks encountered at work.

Context Attributes

The context should include a work-place setting involving a team of three to six members. The context should be presented in the form of a scenario describing the work place, a specific task or problem facing the team, and a description of the goals, knowledge, concerns, priorities, etc. of each team member and the corresponding positions which they take in relation to the given task or problem. In addition to the common task or problem, there should be some diversity and contradiction in the positions taken by the team members.

Question Attributes

Three types of essay questions, corresponding to the three cognitive indicators, should be asked.

1. Students should be asked to write a short essay identifying the ways in which the team members are dependent on each other to accomplish individual and team goals.

2. Students should be asked to fairly represent in essay form, using their own words, the positions of the various team members. Students should include in their essay the reasons behind each member's position.

3. Students should be asked to integrate the information and positions offered by each member into a solution which is optimally effective for the group as a whole as well as for the individual members. The solution, along with an explanation of the ways in which the solution

solves the problem and satisfies, to the extent possible, the individual members' interests, should be presented in essay form.

Response Attributes

Because the responses to the above test items are in essay form, specifications for response attributes and scoring have been adapted from Baker et al.'s (1991) work in content assessment. Baker et al. (1991) elaborate an approach to content assessment that involves rating essays along several dimensions, with scores ranging from 0 to 5 on each dimension. The relevant dimensions are determined by analysis of expert responses to the same test items. Baker et al. (1991) elaborate methods of determining scoring dimensions as well as methods of training raters and scoring. The dimensions implied by the integrative negotiation literature are described below, along with scoring guidelines. Studies validating these dimensions and guidelines will need to be conducted.

Item 1: Articulate Common Goals

1. **General Impression – Content Quality**

   How thoroughly, accurately, and persuasively does the student identify and explain the parties' common goals and interdependency?

   (0-5 point global rating: 0=no response, 5=highest level of thoroughness, accuracy, and persuasiveness)

2. **Identification of Interdependence of the Parties**

   This is a measure of the number of the parties' common goals accurately identified by the student (e.g., all three want to own and operate their own restaurant successfully) combined with the number of ways identified in which the parties are dependent on each other to achieve common and individual goals. In the sample test item, the parties are dependent upon each other (a) financially—only the capital from all three is sufficient, (b) in scheduling—they need each other to have people to fulfill the various roles, such as manager and chef, during the different shifts, and they need each other (c) for their particular expertise and interests, such as Anthony's skills as a chef, Kathleen's skills in creating an ambiance, and Greg's skills as a business manager.

Score Point Guidelines:

0 = no response
1 = no common goal or point of interdependence identified
2 = one common goal or point of interdependence identified
3 = two common goals or points of interdependence identified
4 = three common goals or points of interdependence identified
5 = four common goals or points of interdependence identified

Item 2: Understand Others' Positions

1. **General Impression – Content Quality**

   How fairly and persuasively does the student represent the positions of the parties?

   (0-5 point global rating: 0=no response, 5=highest level of fairness and persuasiveness)

2. **Number of Positions Identified**

   This is a measure of the extent to which the student identifies each party's positions accurately.

   A *position* in the sample test item is a suggestion for improving The Three Chefs.

   The four basic positions in The Three Chefs scenario are:

   1. Anthony's suggestion that they purchase the food processor.
   2. Anthony's suggestion that they purchase higher quality ingredients.
   3. Kathleen's suggestion that they improve the decor.
   4. Greg's position that they offer moderately priced lunches which can be served quickly.

   Score Point Guidelines:

   0 = no response
   1 = no positions
   2 = one position
   3 = two positions
   4 = three positions
   5 = four positions

3. **Provides Reasons Behind Each Party's Position(s)**

   This is a measure of the extent to which the student documents the reasons for the position each party takes.

An example of a *reason* in the sample test item would be Kathleen's argument that if the decor is not improved, people will not enjoy themselves and won't come back.

Score Point Guidelines:

0 = no response
1 = no reasons
2 = one reason for one position
3 = one reason each for two positions
4 = one reason each for three positions
5 = one reason each for four positions

Item 3: Generation of Creative Solutions

1. **General Impression – Content Quality**

   How thoroughly and persuasively does the student identify the number of positions taken, fairness, and degree of creative integration of positions to generate a solution?

   (0-5 point global rating: 0=no response, 5=highest number of positions taken and greatest level of fairness and creativity)

2. **Number of Positions Represented**

   How many of the positions in the conflict are represented in the solution?

   (0-5 point global rating: 0=no response, 1=no positions, 2=one position, 3=two positions, 4=three positions, 5=four positions)

3. **Fairness**

   Of the positions which are represented, how equally are they represented?

   (0-5 point global rating: 0=no response, 5=highest level of fairness)

4. **Creative Integration of the Positions**

   This is a measure of the extent to which the creative solution is integrative as opposed to distributive. Distributive refers to solutions which are simply compromises on some middle ground between opposing positions. Integrative refers to creative solutions which attempt to integrate positions in such a way that more of the positions can be served.

   (0-5 point global rating: 0=no response, 5=highest level of creative integrative solution)

Example:

Distributive: Greg wants to cut costs and offer food which can be served quicker while Anthony want to buy more efficient equipment and more expensive ingredients to offer fancier food. The fairest solution then is to just stay with the menu they have and not change at all.

Creative Integrative: Greg wants to increase profits by offering food which can be served faster at lunch so they can serve more customers, while Anthony wants to provide fancier food using more expensive ingredients for dinner. The solution is to offer the quick, cheaper kinds of food for lunch and the fancier food for dinner and charge more for it.

Relationship of Scores to SCANS Proficiency Levels

Again, because the Commission's work on specification of proficiency levels is ongoing, it is not possible to establish what scores on these items would constitute a "work-ready" level of proficiency. However, once the Commission's work is completed, scores will be calibrated to the proficiency levels. It is anticipated that the test will be calibrated so that an average score of 3 or 4 on each of the dimensions would indicate work-ready competence.

Summary of Second Instantiation of Assessment Methodology

In this section we have instantiated our methodology (see Table 1) with a second example in the area of interpersonal competence. This instantiation is shown in Table 12. As with our first example (see Table 8), an additional step, "Specify basic skills foundation," is added in the SCANS case.

Table 12

Workforce Readiness Assessment Methodology for SCANS: Example 2

General Methodology	Specific Example
• Select a work environment	Analytically derived
• Job and task analysis	Analytically derived
• Select competency	Interpersonal Competency (SCANS)
• Conduct component analysis of competency	Negotiates
• Specify basic skills foundation	Thinking creatively, making decisions, solving problems
• Create indicator(s) for subcompetency requirement	Articulating common goals, understanding others' positions, creating integrative solutions
• Classify indicator(s) within a cognitive science taxonomy	Integrative negotiation (Womack, 1990)
• Create rapid prototypes of measures of indicator(s) via test specifications	[see Tables 10 and 11]
• Select/develop final measures of indicator(s)	To be done
• Select experimental/analytical design	Criterion groups
• Run empirical studies	To be done
• Analyze statistically	To be done
• Use/create norms	To be done
• Report reliability/validity of indicator(s) measure	To be done
• Report on workforce readiness using multiple indicators	To be done

Where Are We Now?

We have created a good "first cut" of a general methodology for measuring workforce readiness competencies. Further, we have instantiated this methodology with two prototypic examples. Our plans are to (a) create the assessment measure by increasing the number of test items, (b) conduct an empirical study to generate reliability and validity indices, and (c) explore the use of technology to administer, score, and interpret our workforce readiness competency measure.

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Appendix 1

Original Accommodations and Food Services Scenario*

Greg, Anthony, and Kathleen are on the verge of realizing an entrepreneurial dream—opening their own restaurant (The Three Chefs) in a growing southern town. Independently, they have worked hard to reach this point, spending 10 or more years learning the restaurant business, pooling their savings, and borrowing from friends and family to raise the start-up capital they needed. Greg took out a second mortgage on his home to satisfy the local bank's demand for security on a line of credit.

Greg serves as manager and "front-of-the-house" shift supervisor during the day. Kathleen is the lunchtime chef and evening manager. Anthony trains the staff, does the bookkeeping, and prepares the evening meals. Renovation has been completed on the restaurant and most of the new kitchen equipment has been installed. Waiters and waitresses have completed their training and have worked two practice shifts to iron out problems.

Kathleen and Anthony analyzed the "back-of-the-house" work flow during the practice shifts and developed a plan for improving the kitchen's output. They can improve efficiency in the kitchen by almost 20 percent by starting food preparation an hour early and moving one of the work stations to the front of the house. After some discussion, the three of them realized that although the repositioning makes sense, it will probably cost them between $7,000 and $10,000 which they do not have. If their projections are correct, they might be able to afford it after they have made about $250,000 in sales, i.e., in three to four months, if all goes well. They opt to make minor adjustments to the system and refrain from expensive changes until they have seen how the first month's sales and expenses look.

"Here's another way we can control our costs," says Kathleen. "I've come across a new management information system that can generate inventory reports, sales reports, and pricing charts. We can integrate the inventory reports and pricing data to project costs and make menu changes. I've also been looking at several different accounting software packages. I think the software our accountant recommended is the most suitable for our needs. There is a large pool of programmers who know that software, making it easier for us to obtain a consultant on short notice to tailor it to our operation."

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* From SCANS, *What work requires of schools. A SCANS report for America 2000*, June 1991, pp. 9-10.

UCLA's Center for the Study of Evaluation &
The National Center for Research on Evaluation, Standards and Student Testing

EVALUATION COMMENT

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Enhancing the Utility of Performance Assessments

Measurement of Workforce Readiness Competencies: Design of Prototype Measures

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The following report is condensed from CSE/CRESST Technical Report 344, Measurement of Workforce Readiness Competencies: Design of Prototype Measures. The complete report and a related study, Technical Report 343, Measurement of Workforce Readiness: Review of Theoretical Frameworks, are available through the CRESST offices. See page 20 to order.

Current economic difficulties and the challenge of competing in the world market have necessitated a rethinking of American approaches to the utilization of people in organizations. Management now recognizes a need to have workers take on more responsibility at the points of production, of sales, and of service rendered, if the United States is to compete in rapidly changing world markets. In order to adapt to the need to introduce new products and services quickly with high quality, new directions in management emphasize participative management, flatter organizational structure, just-in-time management, and team work. This development means that much more is expected of even entry-level members of the American workforce.

The need of American management for workers with greater skills and who can take on greater responsibility has spawned many commissions, task forces and studies. All of them have contributed to the vast evidence documenting the need for a more highly skilled workforce. What remains largely undone is the development of methods to assess the necessary skills that have been identified.

The purpose of this report is to suggest a general methodology for measurement of workforce readiness competencies utilizing previous research from the Secretary's Commission on Achieving Necessary Skills (SCANS). We have focused on the interpersonal competency in this article; however, readers interested in the topic should consider reviewing the two full CSE/CRESST technical reports that explain our research in detail.

(continued on page 2)

Measurement of Workforce Readiness Competencies: Design of Prototype Measures

Workforce Readiness Assessment Methodology

The methodology that we will document in this report consists of 14 steps, from the initial selection of a work environment to the report documenting the process (see Table 1). As seen in Table 1, following selection of a work environment, a job and task analysis is conducted to determine the requirements for the job. Then a competency or skill is selected that is assumed or documented to be present in the work environment. Possible competencies would be academic (e.g., reading) or interpersonal skills (e.g., participating as a member of a team), etc. Unfortunately, such molar categories do not map directly onto an assessment measure, and some further level of decomposition is required. Thus, the cognitive analysis step is implemented and a component analysis is conducted in order to analyze the competency into its constituent subcompetencies. Next, indicators are created for the subcompetencies.

Table 1

Workforce Readiness Assessment Methodology

- Select a work environment
- Job and task analysis
- Select competency
- Conduct component analysis of competency
- Create indicator(s) for subcompetencies
- Classify indicator(s) within a cognitive science taxonomy
- Create rapid prototypes of measures of indicator(s) via test specifications
- Select/develop final measures of indicator(s)
- Select experimental/analytical design
- Run empirical studies
- Analyze statistically
- Use/create norms
- Report reliability/validity of indicator(s) measure
- Report on workforce readiness competency using multiple indicators

The indicators are then classified within a cognitive science taxonomy. The purpose of this step is to allow generalization of the findings from an indicator to a high-order subcompetency. Then, measures of the competency are selected or developed in two steps: (a) rapid prototypes are developed and tested, and (b) prototypes are refined into final measures. Both process and outcomes are measured. Next, an experimental/analytical design is selected and empirical studies run. The data are statistically analyzed with a focus on psychometric issues (e.g., internal consistency, construct validity), and norms are used or created. A report on the reliability and validity of the indicator is written. Finally, a report on the assessment of the workforce competency using multiple indicators is written.

The application of this general method to a specific case for SCANS will be documented in this report and follows in the next section. This report uses several analytical approaches as "proof of concept" of our methodology but does not provide an empirical study. Empirical validation will be conducted in the next year of this effort.

Measurement of Workforce Readiness Competencies: Design of Prototype Measures

SCANS

SCANS was a commission charged by the U.S. Secretary of Labor to investigate what is required in today's and tomorrow's workplace and to determine the extent to which high school students are able to meet those requirements. Specifically, SCANS was directed by the Secretary of Labor to (a) define the skills needed for employment, (b) propose acceptable levels of proficiency, (c) suggest effective ways to assess proficiency, and (d) develop a dissemination strategy for the nation's schools, businesses, and homes.

In June 1991, the Commission issued a report concerning the first two directives (SCANS, 1991). The Commission, based on its discussions and meetings with business owners, public employers, unions, and workers and supervisors in shops, plants, and stores, identified five competencies in accordance with the first directive: the ability to efficiently use (a) resources, (b) interpersonal skills, (c) information, (d) systems, and (e) technology (see Table 2).

(continued on page 4)

Table 2 SCANS: Five Competencies (SCANS, 1991, p. 12)

Resources: Identifies, organizes, plans, and allocates resources

A. *Time*—Selects goal-relevant activities, ranks them, allocates time, and prepares and follows schedules
B. *Money*—Uses or prepares budgets, makes forecasts, keeps records, and makes adjustments to meet objectives
C. *Material and Facilities*—Acquires, stores, allocates, and uses materials or space efficiently
D. *Human Resources*—Assesses skills and distributes work accordingly, evaluates performance and provides feedback

Interpersonal: Works with others

A. *Participates as Member of a Team*—Contributes to group effort
B. *Teaches Others New Skills*
C. *Serves Clients/Customers*—Works to satisfy customers' expectations
D. *Exercises Leadership*—Communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies
E. *Negotiates*—Works toward agreements involving exchange of resources, resolves divergent interests
F. *Works with Diversity*—Works well with men and women from diverse backgrounds

Information: Acquires and uses information

A. *Acquires and Evaluates Information*
B. *Organizes and Maintains Information*
C. *Interprets and Communicates Information*
D. *Uses Computers to Process Information*

Systems: Understands complex inter-relationships

A. *Understands Systems*—Knows how social, organizational, and technological systems work and operates effectively in them
B. *Monitors and Corrects Performance*—Distinguishes trends, predicts impacts on system operations, diagnoses deviations in systems' performance and corrects malfunctions
C. *Improves or Designs Systems*—Suggests modifications to existing systems and develops new or alternative systems to improve performance

Measurement of Workforce Readiness Competencies: Design of Prototype Measures

Table 2 *(continued)* SCANS: Five Competencies

Technology: Works with a variety of technologies

A. *Selects Technology*—Chooses procedures, tools or equipment, including computers and related technologies

B. *Applies Technology to Task*—Understands overall intent and proper procedures for setup and operation of equipment

C. *Maintains and Troubleshoots Equipment*—Prevents, identifies, or solves problems with equipment, including computers and other technologies

CRESST and its subcontractor, USC, have been asked to suggest effective ways of assessing proficiency levels of the competencies identified by the Commission in its June 1991 report. This article documents progress in the development of an assessment framework and its instantiation in the assessment of the interpersonal competency. It should be noted that while our assessment approach focuses on the interpersonal competency, other workforce-readiness components identified by the Commission are also involved.

Defining the Domain

Interpersonal Competency

Interpersonal skills were identified by the Commission to consist of the ability to participate as a member of a team, to teach others, to serve clients and customers, to exercise leadership, to negotiate, and to work with cultural diversity (SCANS, 1991, p. B1).

In elaborating the cognitive requirements of the interpersonal competency, the Commission defined the following six subcompetencies (SCANS, June, p. B1):

Participates as a Member of a Team. Works cooperatively with others and contributes to group with ideas, suggestions, and effort.

Teaches Others. Helps others learn.

Serves Clients/Customers. Works and communicates with clients and customers to satisfy their expectations.

Exercises Leadership. Communicates thoughts, feelings, and ideas to justify a position; encourages, persuades, convinces, or otherwise motivates an individual or groups, including responsibly challenging existing procedures, policies, or authority.

Negotiates. Works towards an agreement that may involve exchanging specific resources or resolving divergent interests.

Works with Cultural Diversity. Works well with men and women and with a variety of ethnic, social, or educational backgrounds.

Integrative negotiation skills can be defined in terms of three subskills. The first subskill is the ability to understand and articulate the common goals and interdependency of various colleagues with whom one must work closely and cooperatively. Second, integrative negotiation skills include the ability to communicate the interests, values, knowledge, and priorities underlying one's own suggestions, opinions, and decisions at work, as well as the ability to understand and appreciate similar communications from other colleagues and team members.

Measurement of Workforce Readiness Competencies: Design of Prototype Measures

Table 3
Interpersonal Skills

	Working on Teams	Teaching Others	Serving Customers	Leading	Negotiating	Working with Cultural Diversity
Thinking Creatively	S			S	P	
Making Decsions	S			S	P	
Solving Problems	S			S	P	
Seeing Things in Mind's Eye						
Knowing How to Learn						
Reasoning						

Note. S = secondary focus, **P** = primary focus.

Third, integrative negotiation skills include the ability to work with others in integrating (thus, the name) the valuable information gained through this effective communication to generate creative solutions to problems and tasks encountered at work.

The three integrative negotiation subskills can also clearly be seen as cognitive indicators of the "participates as a member of a team" and "exercises leadership" interpersonal subcompetencies, as defined by the Commission.

As seen in Table 3, our analysis of these interpersonal competencies indicates that they also typically draw upon several thinking foundation skills. In particular, creative-thinking, decision-making, and problem-solving skills (SCANS, 1991, pp. C1-C2) are required for and are indicated by proficiency in integrative negotiation. In sum, research on integrative negotiation skills documents important cognitive indicators of the interpersonal and thinking skills competencies identified by the Commission as critical to performance in the workforce.

Drawing upon a workforce scenario (see Table 4) described in the SCANS report (SCANS, 1991, pp. 9-10), sample test items for integrative negotiation skills were developed (see Table 5). The SCANS report describes three friends' endeavor to open their own restaurant to portray the Commission-identified competencies in the accommodations and food services sector of the economy. Our modified version below expands on each person's background and responsibilities and indicates how those differences in background and responsibilities led to divergent interests

(text continued on page 8)

Measurement of Workforce Readiness Competencies: Design of Prototype Measures

Table 4
Workforce Scenario

Greg, Anthony, and Kathleen have just embarked upon their entrepreneurial dream—opening their own restaurant (The Three Chefs) in a growing southern town. Each of them independently worked hard to get to this point, spending 10 or more years learning the ropes in the restaurant business, pooling their savings, and borrowing from friends and family to get the start-up capital they needed.

Greg has worked in the restaurant business the longest and has been wanting to start his own restaurant for several years so he could be his own boss and enjoy the benefits of his own labor. Greg has managed several restaurants and enjoys using his business skills to make restaurants a successful business endeavor. Greg put up 10% more start-up cash than Anthony and Kathleen and also took out a second mortgage on his home to satisfy the local bank's demand for security for operating credit. He serves as manager and "front-of-the-house" shift supervisor during the day.

Anthony loves to combine his creative talent with the skills he gained at a culinary arts school he attended in the Northeast to produce unique and delicious gourmet delights. Anthony trains the staff, does the bookkeeping, and prepares the evening meals, which he loves the most.

Kathleen has always enjoyed the restaurant business for the service it provides of offering a pleasant environment in which family and friends can enjoy a meal together. Kathleen majored in interior design in college and enjoys using the skills she gained to improve the ambiance of a restaurant. Even when not working, Kathleen enjoys going out with friends and family to a restaurant. She is the lunchtime chef and evening manager.

Table 5
Sample Test Items

Item 1: Articulate Common Goals
Write a short essay explaining the goal(s) which Greg, Anthony, and Kathleen have in common. Also explain the ways in which they need each other to accomplish their goals.

Item 2: Understand Others' Positions
The Three Chefs has been in business for one month. It has been moderately busy in that time. During the month, each partner has formed ideas and opinions about how to improve The Three Chefs. They have come together on Monday morning to discuss their various ideas. They have agreed that they will meet weekly at this time for 45 minutes to discuss the business. They have also agreed that they will take turns chairing the meeting, and it was decided that Greg would chair the first meeting.

Greg calls first on Anthony, who is hardly able to restrain his enthusiasm to express his suggestions. Anthony begins by telling Kathleen and Greg about a new commercial food processor he learned of through one of his old classmates at the culinary arts school. As Anthony explains different features of the processor, he comments on all the wonderful dishes he could prepare with it. He believes that the expense of the equipment, which is considerable, will be offset by the volume of business they will do by offering

Table 5 *continued*

such wonderful food and by being able to charge more for it. He therefore suggests that they purchase the food processor. His discussion of possible new dishes they could offer leads him to a discussion of his other suggestion to order a wider variety of higher quality ingredients in order to serve the truly exquisite food he thinks they should offer.

After listening to Anthony's suggestions, Greg asks Kathleen to share her suggestions. Kathleen says she has received a few comments from their evening customers that The Three Chefs' decor is somewhat barren. Not wanting to expend too much capital without having a sense of how good their business was going to be, the three had decided to initially buy only the essentials for the restaurant's decor. Kathleen suggests that, since they have had an encouraging first month, they should invest in decorating The Three Chefs and offers her ideas of some of the improvements that could be made. Otherwise, she argues, people won't enjoy eating out at The Three Chefs and won't come back.

Pretend that you are Greg. Anthony and Kathleen have expressed their suggestions as described above. It is now your turn, but the 45 minutes allocated for the meeting have been taken up. Knowing that everyone has important preparations to make for the coming day, you suggest that you will write a summary of Anthony's and Kathleen's suggestions as well as your own suggestions rather than explaining them now. It is agreed that you will give this summary to Anthony and Kathleen to read before next Monday when the three of you will continue the discussion. As Greg, write such a summary. You should identify Anthony's and Kathleen's suggestions along with the reasons they offered to support those suggestions. You should try to represent Kathleen's and Anthony's positions as fairly as possible, while also representing Greg's position, as if you were Greg. In representing Greg's position, you should keep the following concerns in mind.

First, given that you put up 10% more start-up capital than the others and took out a second mortgage on your home to secure operating credit with the bank, you are quite concerned that costs at The Three Chefs be held to a minimum and profits maximized. Anthony's and Kathleen's suggestions, all of which sound as though they will involve considerable cash outlays, therefore concern you. Second, you have a couple of your own suggestions which correspond to your concerns. You have noticed that many of the lunchtime customers are in a hurry. On several occasions you heard customers commenting that they wished the food would be served more promptly so they wouldn't go over their lunch break. You also observed that between 12:00 and 1:00 it was often quite busy and that customers had sometimes waited for 20 minutes to be seated. Your idea, therefore, is to offer a menu with items which are quicker to prepare to better serve the customers. Furthermore, such a change would allow The Three Chefs to do a higher volume of business and therefore increase profits.

Write a short essay that summarizes everyone's position.

Item 3: Generation of Creative Solutions
With the information given in item 2, devise a compromise which takes into account Greg's, Anthony's, and Kathleen's mutual and individual concerns and suggestions. Your goal should be to devise a compromise which best incorporates the information provided by the three parties and which best and most fairly accommodates each of their positions. Write an essay describing that compromise and how it takes into account the concerns and issues raised.

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(text from page 5)

with regard to suggestions for improving the restaurant. In three different questions, students are asked to perform one of the three cognitive indicators. Following are the item-writing specifications which were used to generate the sample items in Table 5.

Item-Writing Specifications

SCANS Competencies to be Tested (see Table 2)

Competencies of primary focus:

The "negotiates" subcompetency of the interpersonal competency: Works towards an agreement that may involve exchanging specific resources or resolving divergent interests (SCANS, 1991, p. B1).

Competencies of secondary focus:

1. The "exercises leadership" subcompetency of the interpersonal competency: Communicates thoughts, feelings, and ideas to justify position; encourages, persuades, convinces or otherwise motivates an individual or group(s), including responsibly challenging existing procedures, policies, or authority (SCANS, June 1991, p. B1).
2. The "participates as a member of a team" subcompetency of the interpersonal competency: Works cooperatively with others and contributes to group with ideas, suggestions, and effort.
3. The creative-thinking subskill of the thinking skills foundation: Uses imagination freely, combines ideas or information in new ways, makes connections between seemingly unrelated ideas, and reshapes goals in ways that reveal new possibilities.
4. The decision-making subskill of the thinking skills foundation: Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternatives.
5. The problem-solving subskill of the thinking skills foundation: Recognizes that a problem exists (i.e., there is a discrepancy between what is and what should or could be), identifies possible reasons for the discrepancy, and devises and implements a plan of action to resolve it. Evaluates and monitors progress, and revises plan as indicated by findings.

Rationale

Developments in the ways people are organized at work require more interpersonal skills to integrate the input of other members of a team in making decisions, thinking creatively, and solving problems to increase effectiveness.

Content Specification

Cognitive indicators, either known or hypothesized, of the ability to perform the cognitive requirements identified by the Commission should be found in relevant research as a source for test content (Millman & Greene, 1989). In this instance, test content was derived from the research on integrative negotiation skills. The cognitive indicators from the integrative research are summarized as:

1. The ability to understand and articulate the common goals and interdependency of various colleagues with whom one must work closely and cooperatively at work.
2. The ability to communicate the interests, values, knowledge, and priorities underlying one's own suggestions, opinions, and decisions at work, as well as the ability to understand and appreciate similar communications

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from other colleagues and team members.

3. The ability to work with others in integrating the valuable information gained through this effective communication to generate creative solutions to problems and tasks encountered at work.

Context Attributes

The context should include a work-place setting involving a team of three to six members. The context should be presented in the form of a scenario describing the work place, a specific task or problem facing the team, and a description of the goals, knowledge, concerns, priorities, etc. of each team member and the corresponding positions which they take in relation to the given task or problem. In addition to the common task or problem, there should be some diversity and contradiction in the positions taken by the team members.

Question Attributes

Three types of essay questions, corresponding to the three cognitive indicators, should be asked.

1. Students should be asked to write a short essay identifying the ways in which the team members are dependent on each other to accomplish individual and team goals.
2. Students should be asked to fairly represent in essay form, using their own words, the positions of the various team members. Students should include in their essay the reasons behind each member's position.
3. Students should be asked to integrate the information and positions offered by each member into a solution which is optimally effective for the group as a whole as well as for the individual members. The solution, along with an explanation of the ways in which the solution solves the problem and satisfies, to the extent possible, the individual members' interests, should be presented in essay form.

Response Attributes

Because the responses to the above test items are in essay form, specifications for response attributes and scoring have been adapted from Baker et al.'s (1991) work in content assessment. Baker et al. (1991) elaborate an approach to content assessment that involves rating essays along several dimensions, with scores ranging from 0 to 5 on each dimension. The relevant dimensions are determined by analysis of expert responses to the same test items. Baker et al. (1991) elaborate methods of determining scoring dimensions as well as methods of training raters and scoring. The dimensions implied by the integrative negotiation literature are described below, along with scoring guidelines. Studies validating these dimensions and guidelines will need to be conducted.

Item 1: Articulate Common Goals

1. **General Impression – Content Quality**

How thoroughly, accurately, and persuasively does the student identify and explain the parties' common goals and interdependency? (0-5 point global rating: 0=no response, 5=highest level of thoroughness, accuracy, and persuasiveness)

2. **Identification of Interdependence of the Parties**

This is a measure of the number of the parties' common goals accurately identified by the student (e.g., all three want to own and operate their own restaurant successfully) combined with the number of ways identified in which the parties are dependent on each other to achieve common and individual goals. In the sample test item, the parties are depen-

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dent upon each other (a) financially—only the capital from all three is sufficient, (b) in scheduling—they need each other to have people to fulfill the various roles, such as manager and chef, during the different shifts, and they need each other (c) for their particular expertise and interests, such as Anthony's skills as a chef, Kathleen's skills in creating an ambiance, and Greg's skills as a business manager.

Score Point Guidelines:

0= no response
1= no common goal or point of interdependence identified
2= one common goal or point of interdependence identified
3= two common goals or points of interdependence identified
4= three common goals or points of interdependence identified
5= four common goals or points of interdependence identified

Item 2: Understand Others' Positions

1. **General Impression – Content Quality**

How fairly and persuasively does the student represent the positions of the parties? (0-5 point global rating: 0=no response, 5=highest level of fairness and persuasiveness)

2. **Number of Positions Identified**

This is a measure of the extent to which the student identifies each party's positions accurately. A *position* in the sample test item is a suggestion for improving The Three Chefs. The four basic positions are:

1. Anthony's suggestion that they purchase the food processor.
2. Anthony's suggestion that they purchase higher quality ingredients.
3. Kathleen's suggestion that they improve the decor.
4. Greg's position that they offer moderately priced lunches which can be served quickly.

Score Point Guidelines:

0= no response
1= no positions
2= one position
3= two positions
4= three positions
5= four positions

3. **Provides Reasons Behind Each Party's Positions**

This is a measure of the extent to which the student documents the reasons for the position each party takes.

An example of a *reason* in the sample test item would be Kathleen's argument that if the decor is not improved, people will not enjoy themselves and won't come back.

Score Point Guidelines:

0= no response
1= no reasons
2= one reason for one position
3= one reason each for two positions
4= one reason each for three positions
5= one reason each for four positions

Item 3: Generation of Creative Solutions

1. **General Impression – Content Quality**

How thoroughly and persuasively does the student identify the number of positions taken, fairness, and degree of creative integration of positions to generate a solution? (0-5 point global rating: 0=no response, 5=highest number of positions taken and greatest level of fairness and creativity)

2. **Number of Positions Represented**

How many of the positions in the conflict are represented in the solution? (0-5 point global rating: 0=no response, 1=no positions, 2=one position, 3=two positions, 4=three positions, 5=four positions)

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3. Fairness

Of the positions which are represented, how equally are they represented?

(0-5 point global rating: 0=no response, 5=highest level of fairness)

4. Creative Integration of the Positions

This is a measure of the extent to which the creative solution is integrative as opposed to distributive. Distributive refers to solutions which are simply compromises on some middle ground between opposing positions. Integrative refers to creative solutions which attempt to integrate positions in such a way that more of the positions can be served. (0-5 point global rating: 0=no response, 5=highest level of creative integrative solution)

Example:

Distributive: Greg wants to cut costs and offer food which can be served quicker while Anthony want to buy more efficient equipment and more expensive ingredients to offer fancier food. The fairest solution then is to just stay with the menu they have and not change at all.

Creative Integrative: Greg wants to increase profits by offering food which can be served faster at lunch so they can serve more customers, while Anthony wants to provide fancier food using more expensive ingredients for dinner. The solution is to offer the quick, cheaper kinds of food for lunch and the fancier food for dinner and charge more for it.

Relationship of Scores to SCANS Proficiency Levels

Again, because the Commission's work on specification of proficiency levels was not complete at the time of our original report, it is not possible to establish what scores on these items would constitute a "work-ready" level of proficiency. However, once the Commission's work is completed, scores will be calibrated to the proficiency levels. It is anticipated that the test will be calibrated so that an average score of 3 or 4 on each of the dimensions would indicate work-ready competence.

Summary of Assessment Methodology

In this report we have applied a methodology (see Table 1) with an example in the area of interpersonal competence. A work environment (restaurant) and job and task analysis were analytically derived. The interpersonal competency was selected, basic skills specified, indicators created and a prototype measure developed.

Where Are We Now?

We have created a good "first cut" of a general methodology for measuring workforce readiness competencies. Further, we have instantiated this methodology with two prototypic examples (one discussed in this report). Our future plans are to (a) create the assessment measure by increasing the number of test items, (b) conduct an empirical study to generate reliability and validity indices, and (c) explore the use of technology to administer, score, and interpret our workforce readiness competency measure.

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